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(71) Applicant: **TOPPAN PRINTING CO LTD**

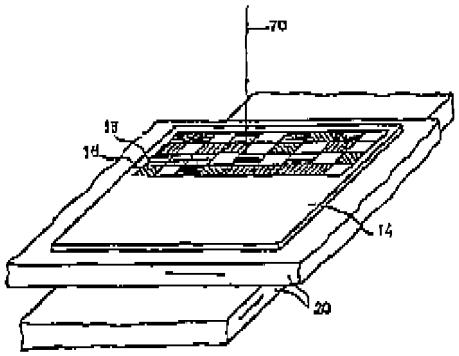
(72) Inventor: **TAKAHASHI SUSUMU**

(54) **DIFFRACTION GRATING PATTERN**

(57) Abstract:

PROBLEM TO BE SOLVED: To make it possible to express fine crest patterns changing with observation positions by specifying a pitch to a specific range.

SOLUTION: A dry plate 14 is placed on an X-Y stage 20. The electron beam 70 shot from an electron gun 50 plots a diffraction grating pattern 18 with a dot 16 as a unit. The diffraction grating patterns 18 are successively plotted, dot by dot, by moving this X-Y stage 20. Namely, data are inputted to a reading computer and visual area data are inputted. Dot data are inputted to the computer to determine the pitch of the diffraction gratings so as to reproduce the colors of the dots. The direction and curvature of the diffraction gratings are determined and the plotting of the diffraction gratings of the dots is executed to complete the plotting. The pitch at which the dots are arranged in these diffraction grating patterns 18 is specified to ≤0.1mm. The entire part of the patterns is, therefore, observed in the ordinary observation position. The fine crest patterns changing with the observation positions are thus formed.



DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]In this invention, a minute diffraction grating (grating) is arranged at a two-dimensional flat surface for every dot.
Therefore, it is related with the diffraction grating pattern formed.

[0002]
[Description of the Prior Art]A display which has a diffraction grating pattern by 2 light-flux interference, and a manufacturing method for the same are indicated by JP,60-156004,A. The method of this conventional technology changes that pitch, a direction, and light intensity, and exposes the minute interference fringe by 2 light-flux interference one after another to a photographic sensitive film.
[0003]
[Problem(s) to be Solved by the Invention]the above -- the pitch of the dot created in a Prior art is large, therefore it changes with observation positions -- thin -- a crest -- a pattern was not able to be created. this invention was made in order to solve the above-mentioned conventional problem, and it changes with observation positions -- thin -- a crest -- it aims at providing the diffraction grating pattern which can express a pattern.
[0004]
[Means for Solving the Problem]A diffraction grating pattern of this invention for attaining the above-mentioned purpose, In a direction [spatial frequency of a diffraction grating the direction of a diffraction grating, a pitch by which each dot is arranged and each dot are located in a line by minute dot which consists of diffraction gratings], any they are changes at least, In a diffraction grating pattern which are arranged and is expressed by substrate face, it is characterized by said pitch being 0.1 mm or less. [two or more]
[0005]In [since a pitch by which each dot is arranged in a diffraction grating pattern of this invention is 0.1 mm or less] the usual observation position, since a dot cannot be observed independently but a pattern is always observed as a whole, it changes with observation positions -- thin -- a crest -- it becomes possible to create a pattern.
[0006]Here, a diffraction grating pattern is a pattern of a bundle ball constituted by each dot, for example, when "1" and "2" estrange and it is drawn by two or more dots, respectively, "1" or "2" constitutes a diffraction grating pattern, respectively.
[0007]

[Embodiment of the Invention]The manufacturing method of the display which has a diffraction grating pattern concerning this invention using electronic beam exposure equipment is explained with reference to drawing 1 thru/or drawing 3. As shown in drawing 1, electronic beam exposure equipment consists of the electron gun 50, the alignment 52, the blanker 54, the condenser lens 56, the SUTIGU meter 58, the deflector 60, the object lens 62, and X-Y stage 20. The EB resist (film plate) 14 is laid on X-Y stage 20. The blanker 54, the deflector 60, and X-Y stage 20 are connected to the computer 66 via the control interface 64. The electron beam irradiated from the electron gun 50 is controlled by the computer 66, and scans the film plate 14 top.

[0008]Drawing 2 shows the film plate 14 laid on X-Y stage 20. The electron beam 70 discharged from the electron gun 50 makes the dot 16 a unit, and draws the diffraction grating pattern 18. By moving X-Y stage 20, the one diffraction grating pattern 18 after another is drawn for every dot.

[0009]With reference to drawing 3, an operating procedure is explained below. First, in Step a, image data is read using an image scanner and it inputs into a computer. Or the image data of computer graphics may be inputted into a computer. Next, in Step b, in order to prepare the appearance of the inputted image data, image data is corrected. Since the portion of edge is notched, the image data read with an image scanner corrects a picture by computer. Next, viewing area data is inputted into a computer in Step c. This viewing area data appoints the direction and viewing area in which that display appears for every dot, when the inputted image data is reproduced as a display. Next, in Step d, an X-Y stage is moved to the starting point, and dot data are inputted into a computer at Step e. These dot data are data about the place of one dot, the color (spatial frequency) of that dot, the direction that dot is visible, and the range that dot is visible among the corrected image data. Next, it asks for the pitch of a diffraction grating at Step f so that the color of the dot inputted at Step e may be reproduced. The direction of a diffraction grating is searched for at Step g so that the direction which is visible may be reproduced. It asks for the curvature of a diffraction grating at Step h so that the range which is visible may be reproduced. The turn of Step f, g, and h is not restricted to this example, but may turn into what kind of turn. Next, in Step i, an X-Y stage is moved to the position of the dot inputted at Step e, and the diffraction grating of the dot is drawn in Step j. By this step of a series of, drawing of the diffraction grating corresponding to one dot is completed.

[0010]Next, in order to input the data of the following dot in Step k, only 1 increases the address which refers to data. And in Step l, when the image data in this address exists, it returns to Step e, another dot data are inputted, and Step f, g, and h, i, j, and k are repeated. This step of a series of is continued until the image data corresponding to a dot is lost.

[0011]Since an electron beam can be scanned in the various directions according to electronic beam exposure equipment, a desired diffraction grating pattern can be drawn. As shown in drawing 4, it doubles with the pattern which has the spatial frequency f1 in the pattern pile which has the spatial frequency f2, and the diffraction grating pattern in which the spatial frequency f1 and f2 was intermingled can be formed. Thus, according to the diffraction grating pattern which has two or more frequency, neutral colors can be expressed. As shown in drawing 5, the direction of a diffraction grating is changeable for every dot. The diffraction grating which turned [dot / one] to two or more directions can also be made intermingled as shown in drawing 6. According to drawing 5 and a pattern like drawing 6, it is also possible to change the image of a display by the position which

an observer looks at.

[0012]It is also possible to form the dot which has a curve-like diffraction grating as shown in drawing 7. A viewing area can be extended if the diffraction grating of such a curve is formed. As shown in drawing 8, the diffraction grating of concentric circle shape can also constitute a dot. In this case, a viewing area will be 360 degrees, restriction of a viewing area which is looked at by the conventional hologram is lost, and a display can be observed from every position.

[0013]Thus, it becomes possible by using electronic beam exposure equipment to produce a display with an expression more variegated than the case where the laser beam of 2 light flux is used. Thus, the film plate which has the formed diffraction grating can be used as the original edition for a duplicate. In order to reproduce, the embossing method known well is used.

[0014]

[Effect of the Invention]As stated above, this invention can produce the display which has a variegated expression as shown below by forming on a field the dot which consists of a various-shaped diffraction grating.

(a) Since the assembly of the dot which consists of a minute diffraction grating from which spatial frequency differs constitutes the picture, it comes into an observer's eyes, without the illumination light diffusing. Therefore, a bright display can be provided.

(b) Since the combination of a minute dot constitutes the pattern, color matching becomes possible in the accuracy of 0.1 mm or less. therefore -- thin -- a crest -- a pattern with a fine pattern etc. is producible.

(c) The diffraction grating pattern which turned to various directions can be provided. Therefore, it becomes producible [the display from which a pattern changes with the directions which an observer looks at]. If such a display is produced with electronic beam exposure equipment, it can produce more easily.

(d) Since the curved diffraction grating pattern constitutes the dot, the display which has a very large viewing area as compared with the conventional display is producible. If such a display is produced with electronic beam exposure equipment, it can produce more easily.

(e) Since the diffraction grating which has two or more spatial frequency is produced for every dot, the display which has neutral colors can be provided. If such a display is produced with electronic beam exposure equipment, it can produce more easily.

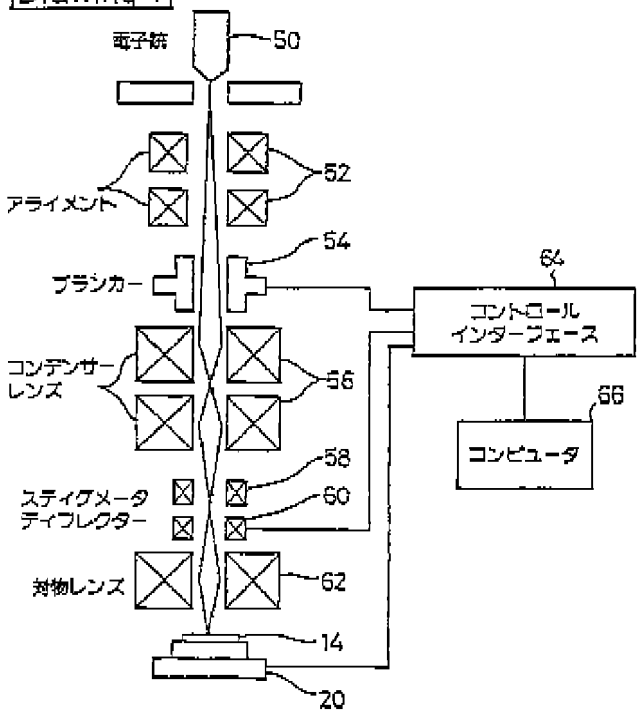
[Translation done.]

* NOTICES *

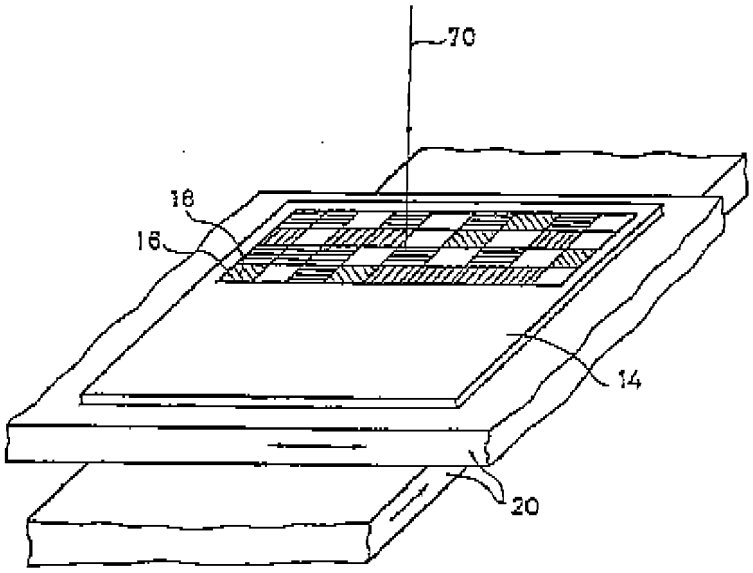
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

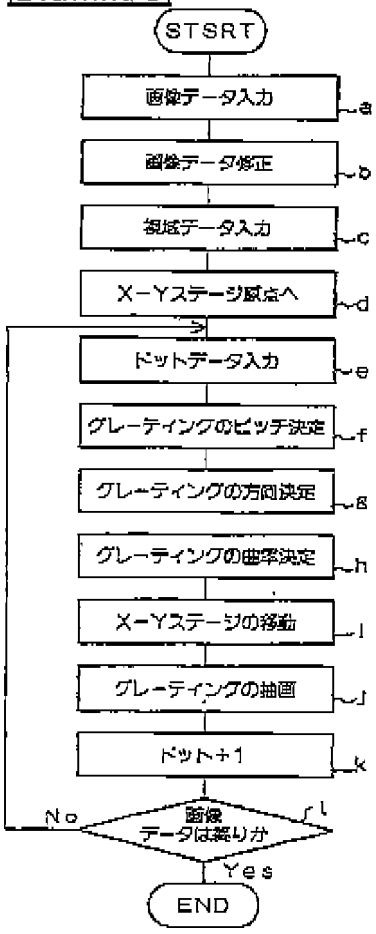
[Drawing 1]



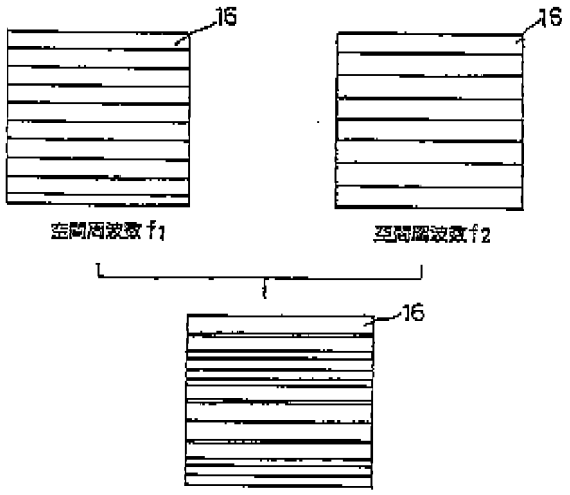
[Drawing 2]



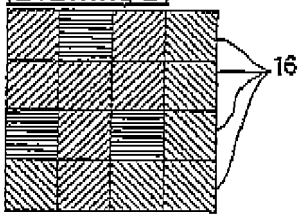
[Drawing 3]



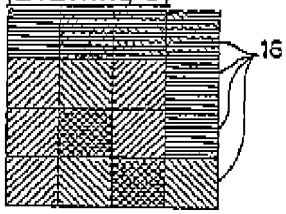
[Drawing 4]



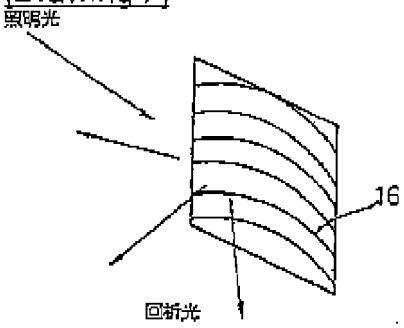
[Drawing 5]



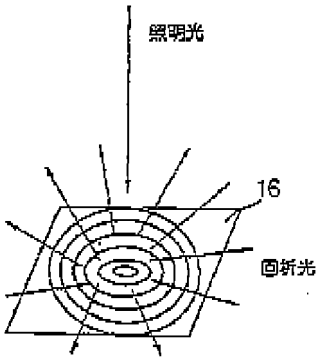
[Drawing 6]



[Drawing 7]



[Drawing 8]



[Translation done.]